CENTRAL INTELLIGENCE AGENCY

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PART II - Report

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1. Subject of Report

In the Spring of 1947 a group of about 50 German engineers were taken by the Soviets from various internment camps in Eastern Germany to MOSCOW. This group was given the task of developing theoretically and practically a remote controlled missile for air launching against sea targets. The report shows the course of the work up to 14th December, 1951 in a general form. A later report will go into greater detail.

2. The Conditions of Employment for the German Engineers

Immediately after the end of W.W. II the Russian Military Administration in Eastern Germany set up internment camps, e.g. SACHSENHAUSEN, BUCHENWALD, NEUE BRANDENBURG, MÜHLBERG, TORGAU, BAUTZEN, JAMLITZ-LIEBEROSE. In June/July 1945 engineering bureaux and radio workshops were set up. These served the double purpose of providing for the needs of the camp administration and also enabling the camp authorities to get an idea of the capabilities of the engineers. For example, in the camp at LANDSBERG A.D. WARTHE in the Summer of 1945 an engineering bureau was set up to which the prisoners had to deliver detailed reports of their work during the war, especially work on secret German war projects. In the camp at SACHSENHAUSEN in the Autumn of 1945 engineers were ordered to write up their detailed backgrounds with specific instructions not to deal with their political history. Only education and professional experience was of interest to the camp authorities. By this means lists of people experienced in the following professions were compiled: physicists, chemists, communication engineers, marine engineers, aircraft constructors. The group of communication engineers dealt with in this report were assembled in the camp at BAUTZEN in March 1947. In May of the same year a Soviet officer, Colonel IWANOW, informed them that they would be required to work at RADEBERG in Saxony. At this time it was promised that they would have an opportunity of corresponding with their families, also improved conditions were promised. IWANOW ordered the group to nominate two engineers from their midst as group leaders, and the following were chosen: Dr. Ing. Christian SORGE and Ing. Otto-Walter SCHMIDT.

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Promises made by IWANOW were not fulfilled and furthermore, the group was transported on the 4th July, 1947 under very primitive conditions to MOSCOW and lodged in the BUTYRSA Prison. In this prison the chosen group leaders had their first conversations with Col. Prof. KUKSENKO and Capt. (later Major) BERIA, the son of the former Minister for the Interior and leader of atomic development in the USSR. These two officers headed the institute in which the group later worked, and on this first occasion KUKSENKO and BERIA made themselves familiar with the state of professional knowledge of the group.

On the 25th September 1947 the group was transferred to a camp at NOVOGORSK, near MOSCOW. Previously, seven men of the total of thirty-six brought to Russia had been taken away. Therefore, the group now consisted of twenty-nine men, being enlarged in the second half of January 1948 by the addition of twenty-six men, who had had a similar recent history to the first group, i.e. they had been interviewed in camps in Eastern Germany, assembled and brought to Russia. The combined group now amounted to fifty-five men. On the 10th December, 1947, 10 engineers from the first group, i.e. the 2 leaders and 8 so-called section leaders, were taken to an institute at 226 Leningrader Chaussee, MOSCOW. Here the 2 leaders SORGE and SCHMIDT were told by KUKSENKO and BERIA of the project on which the group would be required to work. The fact that they would be required to work on a modern development project caused SORGE and SCHMIDT to reflect seriously whether or not they would be well advised to refuse to work. It was, however, pointed out to them that refusal to work on this project would lead to their having to undergo longer imprisonment in Russia under much worse conditions. Therefore, the 2 group leaders agreed that the group would take up the task. From then on, the whole group was transported daily from the camp at NOVOGORSK by bus to work in the institute. At the commencement of the task representations were made to KUKSENKO and BERIA in their respective capacities of scientific and technical head of the institute and to Colonel KUTEPOV, the disciplinary leader (M.V.D.), concerning the promises previously made to the

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German group in BAUTZEN by Colonel IWANOW, i.e. good conditions and permission to correspond with their homes. After these representations, the standard of living was increased somewhat. They were not allowed to take up correspondence with their homes on the grounds that this would have an unfavourable influence on the progress of the work. Permission to correspond was first granted on the 1st April, 1949 at a time when the main work had been accomplished. The group then wrote P.o.W. post cards under the Camp No. 7027/4. It is here remarked that the large P.o.W. Camp KRASNOGORSK-MOSCOW used the numbers 7027/1 and 7027/2. A forest camp belonging to KRASNOGORSK used the number 7027/3. It is to be presumed, therefore, that the postal facilities of the camp at KRASNOGORSK were used for the group. Post was censored by the Political Officer of the Camp at NOVOGORSK, Capt. NOWIKOW. This NOWIKOW frequently stated that during the war he had often flown from England in aircraft but not as a crew member. The camp at NOVOGORSK functioned as a branch of a town prison. The town prison administrating the camp changed several times. At one time it was a children's prison. In this children's prison, Ing. Hans WITTMANN, a former member of the group, spent a period of solitary confinement. It is believed that WITTMANN is nowadays in prison at NOVOTSCHEVKASK, Postfach 5110/52. The supervising town prison had the following personnel at NOVOGORSK: a Camp Commandant Captain LABANOV, a Political Officer Captain NOWIKOW, a doctor, guards, and tradesmen such as tailors, carpenters and cooks. Some of the kitchen personnel were Russian civil prisoners. A female doctor made supplementary visits to the camp at regular intervals. The standard of the food from 25th September 1947, the day of arrival in NOVOGORSK, was of good calory content but was not palatable. The camp of NOVOGORSK lay in the valley of the small lake of NOVOGORSK, near MOSCOW. The village is often not shown on maps but it lies about 8 km west of the MOSCOW-LENINGRAD road, about 20 km from the centre of MOSCOW, on high ground where the MOSCOW-LENINGRAD road crosses the railway. The branch road leading to NOVOGORSK lies some 100 m before the railroad crossing. The asphalted and well kept branch road to NOVOGORSK goes first through the village of MACHKINO. In the camp were two buildings in which it was said TROTSKY's father had once had a spinning and dyeing works. The building for the prisoners is described as follows:-

Dormitory for 55 men (3 sq.m. per man), 3.6m to 4 m high, containing normal iron beds with white bed linen. In the warm part of the year the prisoners were allowed to sleep on a wood-roofed veranda.
Dining room, approx. 4 m x 6 m, the prisoners dining in two shifts. Recreation Room, approx. 4m x 5m.

In the immediate neighbourhood of the prisoners' building was the building for the Soviet Administrative Personnel, with rooms for ammunition storage, boot workshop, tailoring, guard officer and medical officer.

The prisoners were paid as follows:-

From 25th September, 1947 to October, 1949 - 12 roubles per month.
From November, 1949 to January, 1951 - 300-600 roubles per month, according to qualifications.

Now and then premiums were paid to various members of the group.

Prisoners were not allowed to leave the camp or their place of work singly and roll-calls were made morning and evening. As mentioned above, transport between camp and place of work was carried out on strongly guarded buses. In order not to excite notice the Germans were issued with new civil clothing and the guards also wore civil clothing. The institute itself was guarded by an elite troupe of uniformed MVD soldiers. The area of the NOVOGORSK camp was approximately 75m x 40m. There was a board fence, a sterilized zone, and outside this a barbed wire fence. Watchtowers at two corners.

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3. The Professional Capabilities of the Individual Engineers

This section gives an indication of the background and qualifications of the German engineers after the arrival of the second group in January 1948.

BARTIG:	Engineer.	Leader of a Municipal Works in a small industrial town.
BEIER:	"	On centimetre apparatus with TELEFUNKEN.
BERNER:	Physicist.	SIEMENS & HALSKE.
BERNINGER:	Manager of an armament factory.	
BIESCHKA:	Qualified mechanic.	
DAIUGGE:	Engineer.	AEG.
DOMINIK:	Dipl.Ing.	Technical Director of German Broadcasting Company.
EICHNER:	Engineer.	Construction Group Leader - SIEMENS & HALSKE.
KISCHER:	Dr. Ing.	Development and research engineer in the Luftwaffe Research Institute, ADLERSHOF.
VORBACH:	Dipl.Ing.	Small motor development AEG.
FRITSCHE:	Engineer.	Works Manager with LORENZ.
GEISSMANN:	Dr. Ing.	Development Engineer.
GÖB:	Engineer.	TELEFUNKEN.
GOLDBERG:	Dipl.Ing.	Development Manager and Director of OPTA-RADIO, LEIPZIG.
GOLECKI:	Engineer.	Development of radio controlled devices for V2.
GRABOW:	"	Construction Group Leader, LORENZ.
GROSSE:	"	Development of signals equipment.
HAGERMANN:	"	Specialist on gears.
HEID:	"	Manager of an assembly group, Reichspost.
HILSCHER:	Dr. Ing.	Mathematician but had worked on aircraft control, ASKANIA.
HÜFLY	Qualified mechanic and radio operator.	
KEHSE:	Dipl.Ing.	Development of electric motors.
KALBITZ:	Engineer	Head draughtsman, SIEMENS & HALSKE

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KLAIBER:	Dr.rer.nat.	Physicist specialising in carrier telephony SIEMENS & HALSKE.
KNOCH:	Engineer.	
KRANICH:	Dipl.Ing.	Development Engineer.
KONRAD:	Mechanic.	
KRAUTZIG:	"	
KUHFELD:	Engineer.	Manager of an assembly shop.
LEHRBACH:	Fitter.	
LISSITZIN:	Engineer.	Soviet subject from Ukraine. Employed during W.W.II in Germany with HEINKEL Aircraft under the Slave Labour Ordinance.
METZ:	"	SIEMENS & HALSKE.
MORNHINWEG:	Dipl.Ing.	Development of technical test gear with JUNKERS, DESSAU.
MULLER, Kurt	Engineer.	
MULLER, Heinrich	Dr.phil.	Physicist. School Master.
PAHL:	Dipl.Ing.	Development of electro-acoustic equipment.
REH:	Engineer	Independent radio undertaking.
ROMBACH:	"	TELEFUNKEN.
SCHELMEISTER		Physicist and mathematician, AEG, BERLIN.
SCHILLER:	"	
SCHIRGE:	Broadcasting Engineer.	
SCHMIDT:	Engineer.	Development Leader with LORENZ.
SCHRAN:	"	Draughtsman, LORENZ.
SCHWARZ:	"	Draughtsman.
SEEMANN:	"	Development engineer ZEISS, JENA. Decimetre and infra-red.
SENGER:	Dipl.Ing.	
SORGE:	Dr.Ing.	Director and Head of development firm of FRIESECKE and HOPFNER.
SPATH:	Dr.Ing.	Thermodynamics Specialist.
STEIN:	Professor Dr.	Mathematician. State Statistics Office.

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STRAUSS:	Engineer.	Development.
STRESAU:	"	Draughtsman.
THRUN:	Dr.Chemico-Physicist.	Had worked, however, on communication equipment for the greater part of his career with the Air Ministry.
VENT, Arnold:	Dipl.Ing.	Specialist on quartz questions.
VERMEHREN:	Engineer and Fitter.	Transmitters (Communications), TELEFUNKEN.
WITTMANN:	Engineer.	Broadcast Maintenance Engineer.

It will be clear from the above list that no members of the Group could be considered as pulse specialists. On the other hand, the project was of such a nature as to demand the participation of engineers from almost all branches of electronics. One may say that a very judicious selection had been made. Section 6 of this report - Organisation of the Laboratories and the Execution of the Work - shows how the various members of the Group were distributed. In practice, the Group had at its disposal three experienced mathematicians who had worked in industry; fifteen experienced engineers and physicists, and a greater number of engineers and qualified mechanics with long experience in development or maintenance.

/4. Resumé of the Project

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4. Resumé of the Project

With the object of attacking sea targets especially battleships, cruisers aircraft carriers, etc., a missile was to be launched from an aircraft towards the target. The mother-aircraft carries a missile up to the launching point which can be some 120/150 kilometres from the target. When the target has been selected the missile is released and flies under its own power controlled for the first part of its flight by the mother-aircraft. On the aircraft is a three-centimetre magnetron powered pulse transmitter whose radiation is directed on to the target. The missile also is ipse facto directed on to the target. The sharply focussed lobe of the aircraft transmitter rotates at 30 r.p.s. The lobe has a half-power width of some $\pm 2^o$, and makes an angle of 2-3^o with the axis of the aerial mirror. The transmitter is pulse-modulated, the pulse width being 0.5 µs whose p.r.f. is 1250 p.s. The pulses are position-modulated with a deviation of some $\pm 10\%$. The missile has at its rear end an aerial designated 'A'. This 'A' aerial has a half-power width of some $\pm 15^o$ and receives the transmitted radiation with a gain independent of direction of polarisation. The energy picked up by the 'A' aerial goes via a mixer to the in-put of a 40 m/c.s. I.F. amplifier. As stated above, the aircraft mirror is directed on to the target and the axis of this we will refer to as the Leitstrahl. As long as the missile is located on this axis the 'A' aerial will receive an equal field.strength over the whole of the oscillating period of 30 p.s. If, however, the missile deviates from the axis, the energy picked up by the 'A' aerial will vary at a frequency of 30 p.s. The pulses appear to the missile-receiver to be amplitude modulated, therefore, the video impulses from the I.F. amplifier are also amplitude modulated at 30 p.s. This 30 c/s modulation of the video impulses is picked off in a further 30 cycle demodulation stage. The so-designated 30 c/s voltage will in future be referred to as '30 c/s error voltage'. This 30 c/s error voltage does not suffice by itself to correct the deviation from the Leitstrahl. By the introduction of the above-mentioned position modulation of the pulses, we have a second [illegible] voltage - which will be referred to in future as the 'reference voltage' - which is passed through a demodulator. The phase of the reference voltage is constant and independent of the aspect of the missile in space. The phasing of the 30 c/s error voltage is dependent on the aspect of the missile in space and can vary between 0-360^o. The phasing of the second 30 c/s voltage can, as an illustration be determined in the following way: When the transmitted lobe rotating at 30 c/s goes through the zenith, this coincides with the period of closest pulse spacing. The power which produces the 30 c/s. position modulation and the power which produces radiation of the lobe come from the same generator on the aircraft. From the phase difference of the two 30 c/s voltages, two D.C. voltages are formed in two-phase commutators. The phase-commutators are so arranged that one of them delivers a positive D.C. when the missile has a deviation on positive 'x' axis and a negative D.C. when it has a deviation along the negative 'x' axis. The other one delivers a positive D.C. when the missile has a deviation in the positive 'y' direction and a negative D.C. when the missile has a deviation in the negative 'y' direction. If the missile has an 'x' deviation and a 'y' deviation simultaneously, D.C. voltages appear in both phase commutators. These D.C. voltages are fed to the autopilot. This autopilot converts the varying D.C. voltages into corresponding movements of the horizontal and vertical control surfaces. The autopilot provides the necessary damping parameters itself. The 40 m/c.s. I.F. amplifier on the 'A' side is A.V.C. controlled. Therefore the amplitude of the 30 c/s error voltage is independent of the distance of the missile from the mother-aircraft, and only dependent on the deviation angle.

As will be seen, the method so far is similar to that employed in radar apparatuses for automatic follow. For short distances, i.e., short in comparison to the total flight distance of the missile, the Leitstrahl together with the rotating lobe and the time modulation of the pulses forms a co-ordinate system in space. One observes that a turning of the missile about its own axis will result in no alteration of the co-ordinate values obtained from the phase commutators. The automatic frequency control of the local oscillator is achieved in the well-known fashion through a discriminator and a diode-transitron control circuit. From the video impulses of the 'A' receiver a triggerpulse of constant amplitude is generated by a normal blocking oscillator. This circuit is so biased that the blocking oscillator is triggered by the video pulses even when the pulses have the greatest possible degree of modulation. The triggerpulse from the blocking oscillator is used in the gating circuits. When the missile has been controlled by the 'A' receiver to a position sufficiently near to the target, i.e., some 20-30 kilometres from it, a special switching stage removes the control by the aircraft from the 'A' side on to the 'B' side. The 'B' side of the pulse circuits is located in the head of the missile. The aerial mirror of the 'B' side is, of course, directed to the target and receives the 'scatter' from it. To produce the error voltage on the 'B' side, the 'B' antenna rotates at 75 c/s. The half-power width of the receiving lobe amounts to ± 2° and makes an angle of 2-3° with the axis of the 'B' mirror. The pulses picked up by the 'B' aerial are led over a mixer again to 40 m/c.s. I.F. amplifier with very low noise factor. The video impulses derived from this receiver are made available to the gating circuit which with the help of the triggerpulse from the blocking oscillator on the 'A' side only passes the pulses originating from the mother-aircraft. From the selected pulses which can be amplitude modulated the 75 c/s error voltage is formed. From the gate pulses the regulating voltage for the 'B' receiver is also obtained. This regulating voltage is also used for switching control from the 'A' to the 'B' side, the actual switch-over taking place when this regulating voltage reaches a determined value. The dipole of the 'B' antenna is driven by a centrifugal control D.C. motor at 75 c/s; also from the axis of this motor a 75 c/s two-phase generator is driven from which two voltages in quadrature are fed to the phase commutators after the switch-over from 'A' side to 'B' side. As the target is being irradiated, then, the rate of revolution of the 'B' antenna must be chosen to be different from the 30 c/s by the aircraft transmitter lobe which is rotating at 30 c/s, and consequently the 'scatter' may also be modulated in this way, i.e., if the Leitstrahl is not accurately on the target. Theoretical considerations as to the most favourable rate of revolution resulted in the unanimous choice of 75 c/s. It has already been said that the components of the 30 c/s error voltage in the first part of the flight are only dependent on the aspect of the missile in space; a turning of the missile about its own axis - and even an angle of the missile against the Leitstrahl - are without influence on the D.C. components from the phase commutators. Consider the conditions on the 'B' side. We denote a line connecting the centre of gravity of the missile and the target as 'direction of flight'. Then the components of the 75 c/s error voltage, i.e., the D.C. voltages of the two phase commutators are dependent on the angle in space which the missile's axis makes with the direction of flight. If the missile turns about on its own axis or if it yaws, then the co-ordinate system turns with it and the components derived from the dipole of the 'B' aerial and the commutators alter themselves in a way corresponding to the turning angle of the axis. The autopilot registers this turning angle and automatically turns the components back again. As in the first part of the flight, also in the second part, the differential quotient of the control D.C. voltages from the phase commutators is not formed. The autopilot generates also in the second part of the flight the necessary damping parameters. The 'B' receiver, like the 'A' receiver, has A.V.C., therefore the components of the 75 c/s error voltage derived from the phase commutators are independent of the distance of the missile from its target. Given the self-imposed limitation, i.e. to consider a distance short in comparison to the total flight one can say that the method in the first part of the flight is based on a co-ordinating system with reference to the earth, and in the second part of the flight with a co-ordine system based on the missile. For adjustment of zero phase for the constant 30 c/s - and the constant 75 c/s voltage - there is on the 'A' and on the 'B' side a rotatable phase shifter. Especially in the last part of the flight, i.e., at the approach to the target, it is possible that a considerable deviation in the angle between the missile axis and the Leitstrahl will take place and accompanying large turning angles of the missile axis. It is then likely that reception via the 'A' receiver would not longer be possible as also the axis of the 'A' aerial would at this time be making a larger angle with the Leitstrahl. In order to eliminate this possibility the 'A' antenna receives

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automatic follow instructions for movement about two axes. One of those axes corresponds with the missile's length axis, the other runs parallel with the azimuth control surface axis. Mention has already been made of the pulse sender on board the aircraft. It was intended to provide in addition a P.P.I. viewing facility and automatic follow for the aircraft dish in order that the aircraft might, in certain circumstances, be enabled to take evasive action.

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5. <u>The History of the Project</u>

During WW II Soviet Russia suffered more than any other combatant country in its loss of already scarce scientists, Engineers and skilled workers. In order to rectify this in some measure the Soviets took from Germany after the war, not only industrial equipment and materials, but also many different kinds of labour force, particularly engineers and skilled workers for military developments. The methods employed in carrying this out are well known. The engineering group which forms the subject for this report first came into contact with the leaders of their Institute (Prof. KUKSENKO and Capt. BERIA) in ~~BUTYRKA Prison,~~ BUTYRSKIY MOSCOW in August, 1947. On that occasion they first learned the nature of the project on which they would be required to work. The group leaders (SCHMIDT and [illegible]) were made acquainted in detail with the nature of the project. They were shown a write-up consisting of 200 pages. This was the [illegible] Thesis of Capt. BERIA which had been submitted to the War Academy in MOSCOW. It had been produced under the auspices of Prof. KUKSENKO. The paper by BERIA contained an historical survey of the guided missile field, then followed:-

(i) A detailed description of the propagation conditions for centimetre waves.

(ii) Detailed calculations on the field strength of echo signals to be expected from ships.

(iii) Considerations on reflections from the surface of the sea.

(iv) An examination of the circumstances in which ships could be attacked by airborne missile.

(v) Proposals for the design of the wave guides, and the aerials of such a missile.

(vi) Proposals for the design of the IF amplifier, the gating circuits, the phase commutator, the auto pilot and finally the description of the pulse transmitter to be located on the mother aircraft.

In general the paper was based on the experience of development work carried out in the Western countries during the War. A detailed bibliography completed the paper. The intensity with which the Soviets pressed on with the project can be explained by consideration of the political position in which Soviet Russia found itself after the end of WW II. After the destruction of the German army, Russia had become the greatest land power. An antagonistic coalition of countries which would threaten the land power of Russia was not considered a danger to be reckoned with in the immediate future. However, Russia had nothing to oppose to the British and American fleets. The importance of naval power was powerfully demonstrated to the Soviets on two occasions beneficially in WW II. First by the northern convoys which brought them much needed material, and secondly by the landing of the allies in France in June, 1944 which led to an earlier final decision than would have been otherwise possible. With great energy the Russians set out to catch up with modern aircraft techniques after the war, as a quick alternative to building up naval power. It was considered impossible to build a modern fleet quickly. The lack of naval power was again demonstrated to the Russians during the Korean war when U.S. naval forces were able to bring the necessary materials for defence to South Korea. All this caused the Russians to pursue furiously a means of combating naval power by air power. Therefore, the air arm was built up as quickly as possible, and with it the remotely controlled missile

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which was to enable the atom bomb, also being developed at that time, to be brought to bear on shipping. Up to the year 1948 the Soviets had nothing to show in the way of developments on automatic pilots and remotely controlled missiles. They hoped that the project described here, pursued by their native engineers, together with German engineers, would produce a good solution in this field. They also wished to reduce the lead which the Western countries had in this field, and in fact this lead has been shortened. The importance attached to the development of the air/sea missile was underlined by a whole series of visits to the Institute in the LENINGRAD Chaussee, e.g. the War Minister, the Minister for Marine and other very senior officials made frequent visits even when the project was in its infancy. The Soviet scientists and engineers were offered golden opportunities after the war to make themselves familiar with the techniques learned during the war, in the West. The former allies and future opponents of Russia showed no inhibitions in publishing the full results of their long, and one time secret, developments. It was thus possible to build complex equipment without the need for a great deal of basic research work.

6. The Organisation [illegible] the Progress of the Task

The members of [illegible] allotted their tasks some weeks after the leaders had [illegible] task on 10 October, 1947. This Group worked exclusively on the [illegible] equipment for the missile which was given the name Komet by the Soviets. The department for the development of the auto pilot, and the aircraft pulse transmitter was set up in February, 1948. This remained in its original form until February, 1950. The organisation and the department for the development of the missile itself was altered in July, 1948. This was due to a change in the German leadership of the group. When the work was [illegible] on 10 October, 1947, the Institute only contained some writing desks and drawing materials, no other gear was at that time available. The main work of the engineers consisted in the early stages of theoretical planning and calculation of component parts required. These parts were then ordered. The lack of test gear and tools, and the long delivery times associated with them, caused the work to proceed at a slow pace, consequently completion of the first experimental mock-up was much delayed. The position altered fundamentally after the first prototype was finally built and approved by the Soviets. After that the requirements on componenets and test gear were fulfilled in the most generous manner. As far as equipment was to be bought in any country, it was made available to the group. The test gear and component parts in general were of native Russian origin, simple oscilloscopes, 3 cm signal generators, inductance bridges, Q meters, magnetrons: from the Russian occupied Zone of Germany came Telefunken capacity bridges multi purpose test sets, LF generators and copies of Raytheon 25 mW-3 cm Klystrons; from America, Dumont [illegible], valve volt meters, and other test gear; from England, [illegible] oscilloscopes and Marconi test gear of all kinds. At first there was also a certain amount of Lend Lease equipment available.

In October, 1948 the first experimental model of the Komet control gear was completed, but in a [illegible] non airworthy form. The individual components had been built in the laboratory workshop and aluminium sheeting had been largely used. This first model was set up in the large hall of the Institute for provisional testing. After this test a document was drawn up by the Institute [illegible] approved by an unknown outside authority for the building of five airworthy sample models. The first of the five samples had its [illegible] tests on 31 August, 1949. The testing of the other four samples was, after minor modifications, completed in November, 1949. These five samples were not tested in the large hall, but in the test room of the Institute. This consisted of one of the largest laboratory rooms. After the work had commenced in earnest on the five sample models the Soviets [illegible] in for instruction a large number of native male and female engineers. It was quite obvious to the German group that they were also being [illegible] to educate the younger generation of Soviet engineers in the pulse field. In the course of the further development work it was explained by KURSENKO that the intention was for the German group to form the frame-work of the Institute. At the end of 1948 in addition to the numerous civil Soviet engineers several Soviet engineer officers appeared who were required to make themselves thoroughly familiar with the project in detail. All the Soviet personnel, civil and military, working together with the Germans were withdrawn over the period December, 1949 to April, 1950. The leaders of the German group were required in the middle of 1949 [illegible] out a detailed technical report on the control equipment of the [illegible]. The report contained calculations on the method and descriptions of the individual components with photographs. In the report, earlier partial reports of individual laboratories were constructively criticized. At the beginning of September, 1949 the German group leaders were ordered to produce a test apparatus for use at

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an unknown coastal aircraft base. They proposed firstly to build the necessary test gear from equipment already available in the laboratories. A second proposal was to design and build a completely new test apparatus. The Soviet Institute leaders accepted this second proposal. The first tentative test apparatus was completed at the end of 1949, and two of an improved model, i.e., capable of being used in the field were produced in May, 1950. BERIA stated that the Soviet engineers themselves would make a third test apparatus. After the last of the Soviet engineers had been withdrawn in April, 1950, the German group were occupied with a series of miscellaneous tasks. These tasks consisted in general of developing test equipment which was either not available or in short supply in Russia. In the course of this work from April, 1950 to February, 1951 they developed and built the following-

A quartz frequency standard.
A pulse spectrum analyser.
Wobbulator for testing IF amplifiers.
An improved version of the Dumont pulse oscilloscope. (This latter was a very satisfactory job and twenty-five of them were built for use in the laboratories.)
A pulse power meter.
Valve voltmeter.
Magnetic voltage regulator.

7. During this latter period the Soviets went to considerable lengths to prevent the German group from learning the results of the flight tests of the Komet.

PART III. LIST OF PERSONALITIES

Nil

PART IV. LIST OF APPENDICES AND ANNEXES

Appendices - Nil

Annexes -

A. Radiation from A/C (rotating)

B. Sketch of pulse cycle.

C. Co-ordinate system of A. side.

D. Co-ordinate system of B. side (I)

E. Co-ordinate system of B. side (II)

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SECRET Annex A

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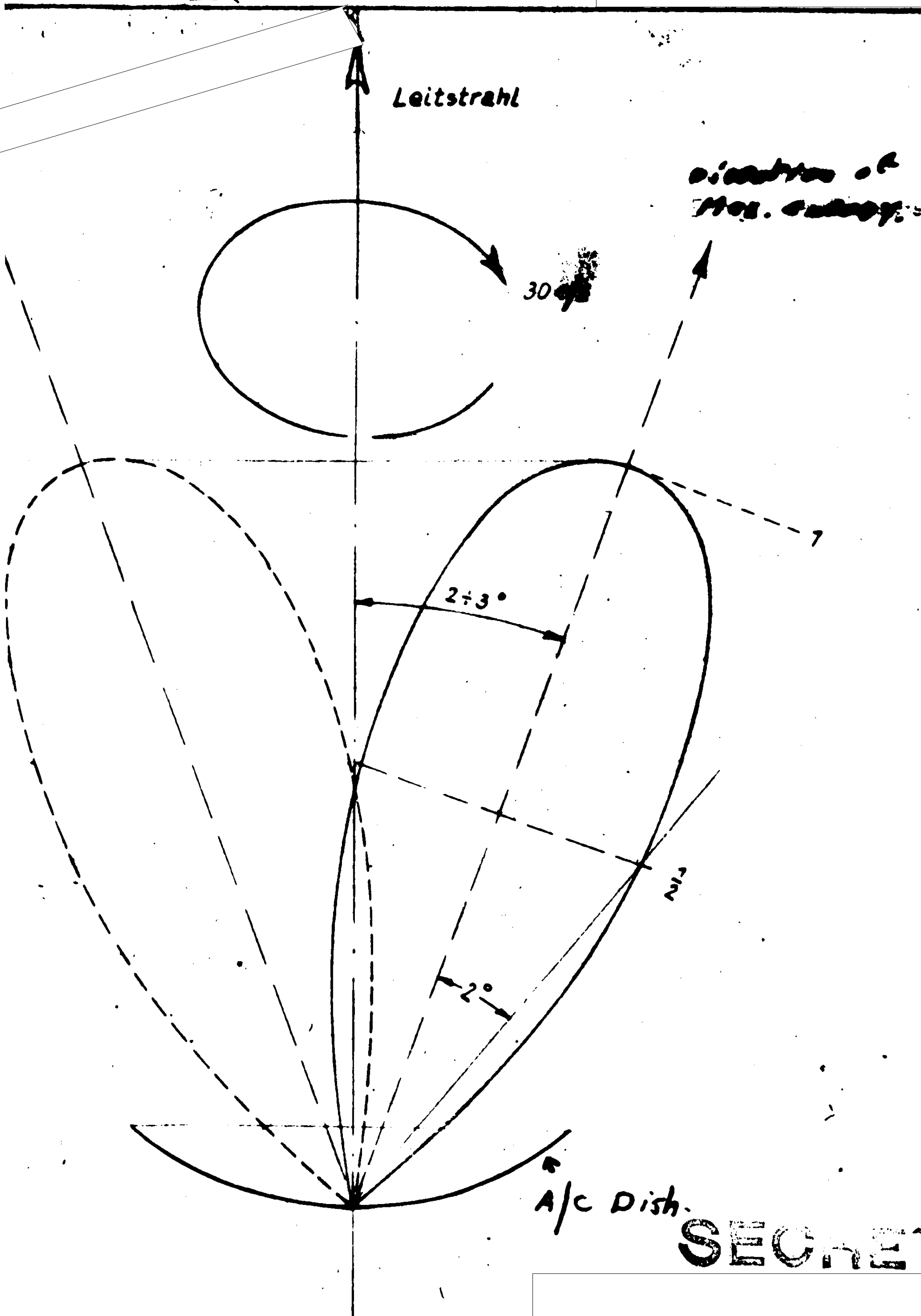


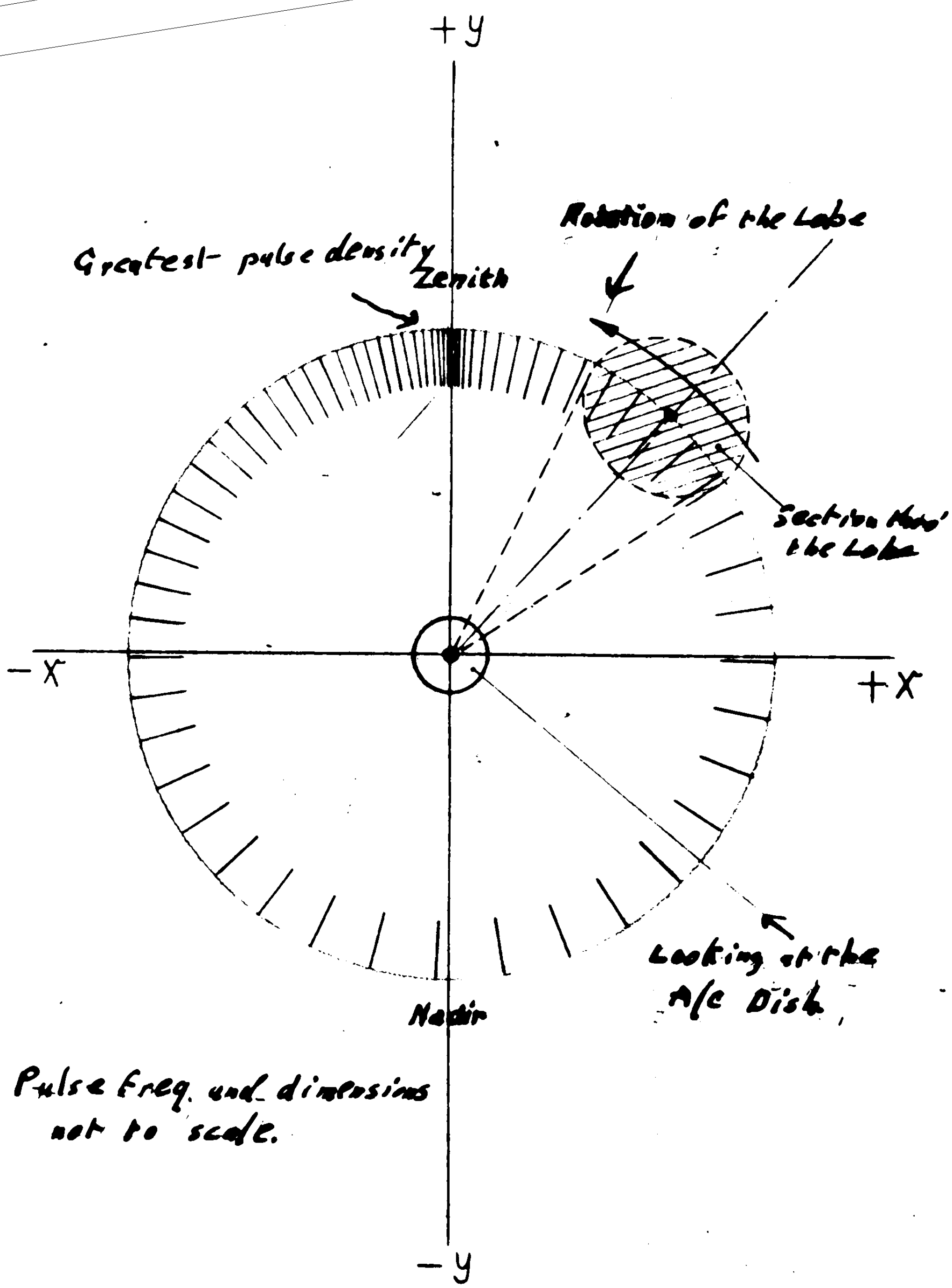
SECRET 25X1

Radiation from A/c. (rotating)
(Angle scale enlarged)

SECRET Annex B

25X1

25X1



Pulse Freq. and dimensions not to scale.

SECRET

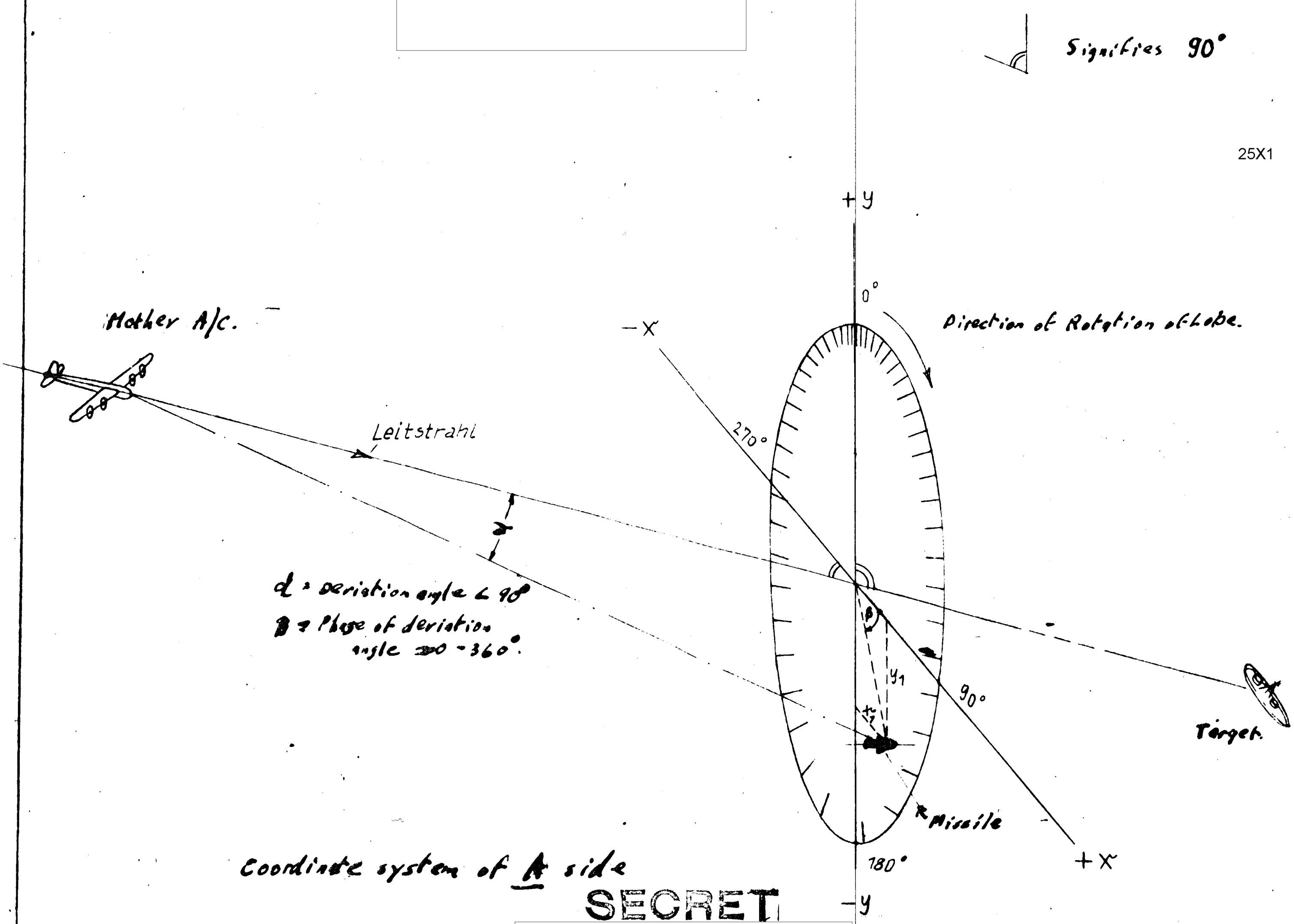
25X1

SECRET

Annex C.

25X1

25X1



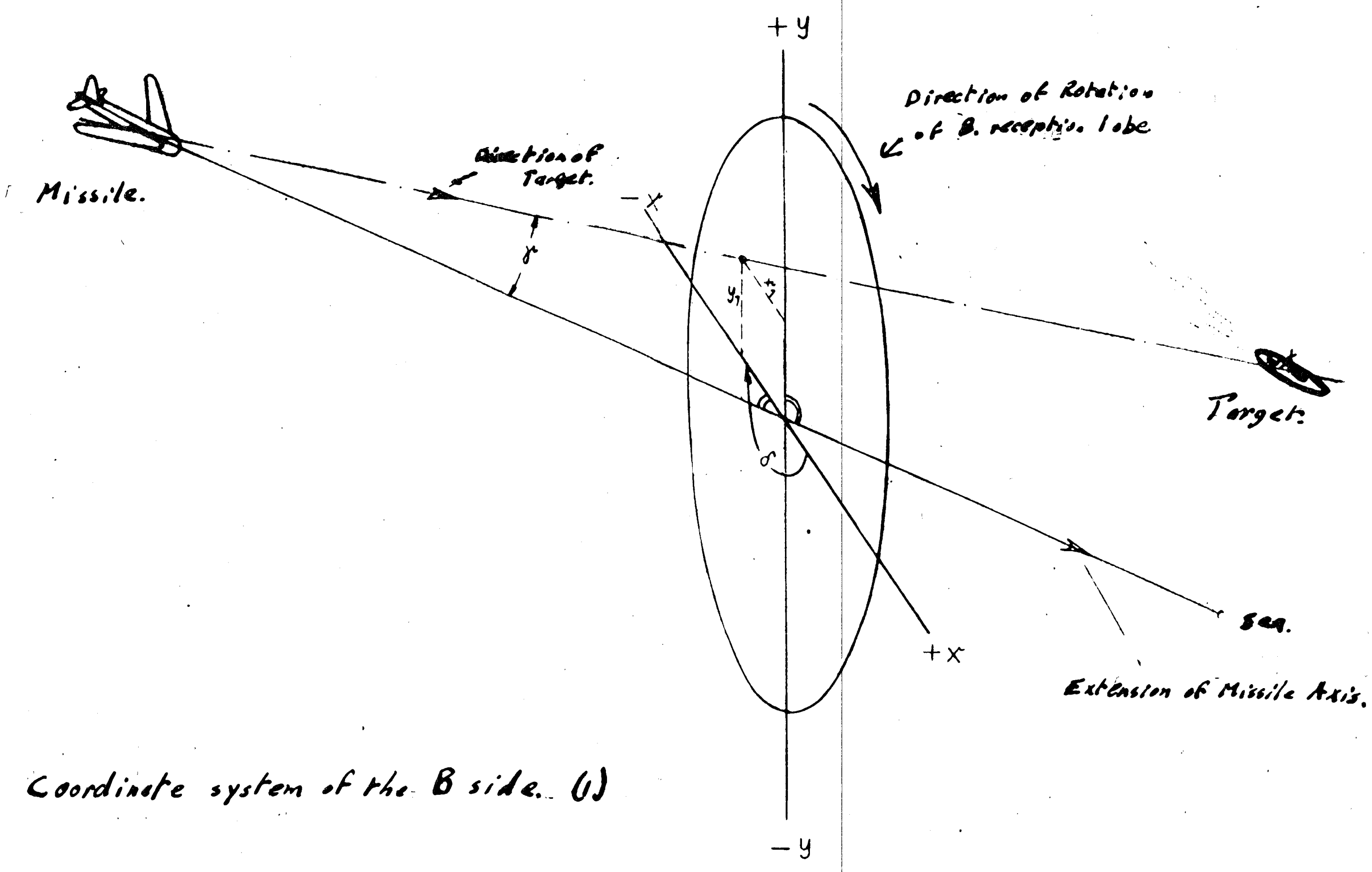
Coordinate system of A side

SECRET

25X1

[redacted] 25X1

[redacted] 25X1



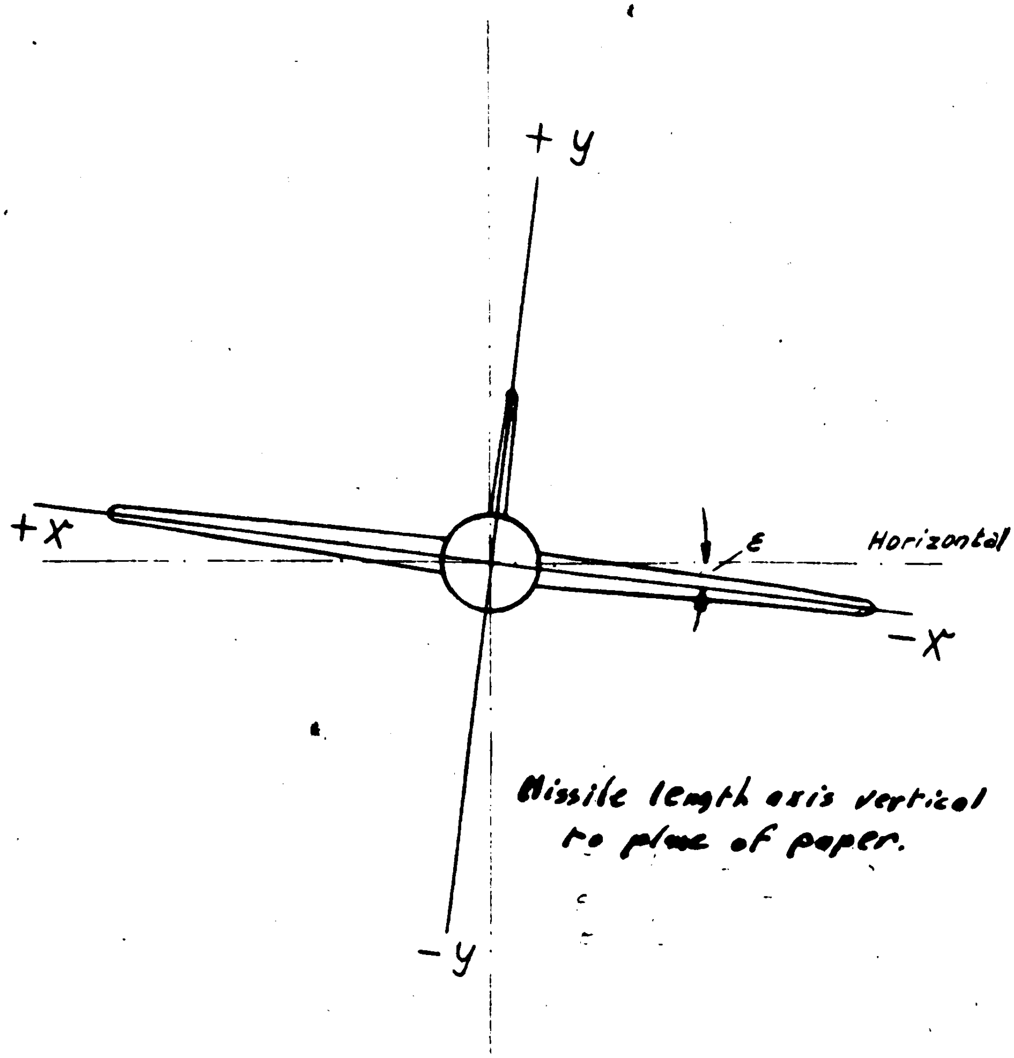
Coordinate system of the B side. (1)

[redacted] 25X1

SECRET Annex E

25X1

25X1



Coordinate system of the B side. (11)

SECRET

25X1